



United Kingdom of Great Britain and Northern Ireland

EDICT OF GOVERNMENT

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BS NA EN 1993-1-10 (2005) (English): UK National Annex (informative) to Eurocode 3. Design of steel structures. Material toughness and through thickness properties

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NA to BS EN 1993-1-10:2005



BSI Standards Publication

National Annex (informative) to Eurocode 3 – Design of steel structures –

Part 1-10: Material toughness and through
thickness properties

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ISBN 978 0 580 54972 4

ICS 91.080.10

The following BSI references relate to the work on this National Annex:

Committee reference B/525/10 and B/525/31

Draft for comment 07/30128140 DC

Publication history

First published January 2009

Amendments issued since publication

Date	Text affected
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National Annex (informative) to BS EN 1993-1-10:2005, Eurocode 3 – Design of steel structures – Part 1-10: Material toughness and through thickness properties

Introduction

This National Annex has been prepared by BSI Subcommittee B/525/10, *Bridges*, in consultation with B/525/31, *Structural use of steel*. In the UK it is to be used in conjunction with BS EN 1993-1-10:2005.

NA.1 Scope

This National Annex gives:

- a) the UK decisions for the Nationally Determined Parameters described in the following clauses and subclauses of BS EN 1993-1-10:2005:
 - 2.2(5)
 - 3.1(1)
- b) references to non-contradictory complementary information.

NA.2 Nationally Determined Parameters

NA.2.1 Procedure [BS EN 1993-1-10:2005, 2.2(5)]

NA.2.1.1 Safety element

NA.2.1.1.1 Factors affecting safety elements

The value of ΔT_R should be obtained from the following equation:

$$\Delta T_R = \Delta T_{RD} + \Delta T_{Rg} + \Delta T_{RT} + \Delta T_{R\sigma} + \Delta T_{Rs}$$

where:

ΔT_{RD} is an adjustment for the detail type (see NA.2.1.1.2);

ΔT_{Rg} is an adjustment for the gross stress concentrations (see NA.2.1.1.3);

ΔT_{RT} is an adjustment for Charpy test temperature (see NA.2.1.1.4);

$\Delta T_{R\sigma}$ is an adjustment for the applied stress level (see NA.2.1.1.5);

ΔT_{Rs} is an adjustment for the strength grade (see NA.2.1.1.6).

The procedures in NA.2.1.1.2 to NA.2.1.1.6 for ΔT_R are consistent with $\Delta T_\sigma = 0^\circ\text{C}$.

Reference to guidance giving recommended maximum permissible values of element thickness t for reference temperatures below -50°C is given in NA.3.

NA.2.1.1.2 Adjustment for detail type, ΔT_{RD}

The value of $\Delta T_{RD} = 0$ should be used except as follows:

a) unwelded details:

- for unwelded as-rolled, ground or machined surfaces, a value of $\Delta T_{RD} = +30$ °C should be used;
- for unwelded mechanically fastened joints or flame cut edges, a value of $\Delta T_{RD} = +20$ °C should be used;

b) welded details:

- for welded details, the value of $\Delta T_{RD} = 0$ °C should be used, except for those locations given in Table NA.1.

Table NA.1 Values of ΔT_{RD} for specific welded locations

Component or detail	Initiation site	Attachment dimensions ^{A)}		ΔT_{RD} (°C)
		Length (mm) ^{B)}	Width (mm) ^{C)}	
Welded attachment	Transverse weld toe	>150	≤50	-20
			>50	-30
Member fabricated from plates	Transverse butt weld ^{D)}	—	—	-20
Rolled sections	Transverse butt weld ^{D)}	—	—	-30

A) Measured overall between weld toes on member concerned.
 B) Measured in direction of tensile stress.
 C) Measured transverse to direction of tensile stress.
 D) Applies only to welds joining the full cross section, not those joining individual plates prior to sub-assembly).

NA.2.1.1.3 Adjustment for gross stress concentration, ΔT_{Rg}

The value of ΔT_{Rg} should be applied for initiation sites in regions of gross stress concentration in accordance with Table NA.2.

Table NA.2 Values of ΔT_{Rg} according to gross stress concentration factor
Units in degrees Celsius (°C)

Stress concentration factor	ΔT_{Rg}
1	0
1.5	-10
2	-20
3	-30

NA.2.1.1.4 Adjustment for Charpy test temperature, ΔT_{RT}

The values of ΔT_{RT} according to the difference between the Charpy test temperature T and the minimum steel temperature ($T_{md} + \Delta T_r$) should be as given in Table NA.3.

Table NA.3 **Values of ΔT_{RT} according to difference between Charpy test and minimum service temperatures**
Units in degrees Celsius ($^{\circ}\text{C}$)

Application	$T - (T_{md} + \Delta T_r)^{A)}$	$\Delta T_{RT}^{A)}$
General (except bridges conforming to BS EN 1993-2)	≤ 20	0
	25	-10
	30	-20
	35	-30
	$>35 \leq 40$	-40 restricted use ^{B), C)}
	>40	Not permitted ^{B)}
Bridges conforming to BS EN 1993-2	≤ 20	0
	>20	Not permitted ^{B)}

A) Intermediate values should be obtained by linear interpolation.

B) See NA.2.1.2.

C) Welded joint types where either $\Delta T_{RD} + \Delta T_{RG} < 0^{\circ}\text{C}$ or $\Delta T_{RG} < 0^{\circ}\text{C}$ should not be used in tension if $T - (T_{md} + \Delta T_r) > 35^{\circ}\text{C}$ (see Tables NA.1 and NA.2 respectively). No type of welded joint should be used in tension in this temperature condition where $\Delta T_e < 0^{\circ}\text{C}$ (see BS EN 1993-1-10:2005, 2.2 and 2.3).

NA.2.1.1.5 Adjustment for applied stress, ΔT_{RG}

For $\sigma_{Ed} = 0.75f_y(t)$, ΔT_{RG} may be taken as zero. For $\sigma_{Ed} < 0.75f_y(t)$, the values for $0.75f_y(t)$ should be used, but adjusted by use of a ΔT_{RG} value for lower values of σ_{Ed} as given in Table NA.4. Linear interpolation may be used for intermediate values of σ_{Ed} in Table NA.4.

Table NA.4 **Values of ΔT_{RG} for maximum tensile stresses less than $0.75f_y(t)$**
Units in degrees Celsius ($^{\circ}\text{C}$)

σ_{Ed}	ΔT_{RG}
$0.5f_y(t)$	0
$0.3f_y(t)$	+10
$0.15f_y(t)$	+20
≤ 0	+30

NA.2.1.1.6 Adjustment for steel grade, ΔT_{RS}

The values of ΔT_{RS} should be as given in Table NA.5.

Table NA.5 **Values of ΔT_{RS} according to steel grade**
Units in degrees Celsius ($^{\circ}\text{C}$)

Steel grade	ΔT_{RS}
$< S355$	+10
S355	0
$> S355$	-10

NA.2.1.2 Charpy test and reference temperatures and applied stress**NA.2.1.2.1 Charpy test and reference temperatures**

The maximum range between T_{Ed} and the Charpy test temperature T should be limited such that the recommended values given in Table NA.3 are achieved.

NA.2.1.2.2 Range of σ_{Ed}

The use of Table 2.1 should be restricted to the values of t given for $\sigma_{Ed} = 0.75f_y(t)$. For other values of σ_{Ed} , see **NA.2.1.1.5**.

NA.2.1.3 Limitation of steel grade

Table 2.1 may be used for steel grades up to and including S690 (subject to the recommendations given in **NA.2.1.1.6**).

NA.2.2 Quality class for through thickness properties [BS EN 1993-1-10:2005, 3.1(1)]

Class 2 should be used. Reference to design guidance is given in **NA.3**.

NA.3 References to non-contradictory complementary information

Complementary guidance on toughness and through thickness properties is given in PD 6695-1-10.

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PD 6695-1-10, *Recommendations for the design of structures to BS EN 1993-1-10*

BS EN 1993-2, *Eurocode 3 – Design of steel structures – Part 2: Steel bridges*

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